Chapter 3 starts here

ATOMS

Atoms - smallest particle of an element.

Democritus 460 BC
↳ Greek Philosopher - 1st thought of the atom - If you break down matter more and more eventually it will be indivisible - Atom.

John Dalton - 1803 - Atomic theory
↳ Based off of law of conservation of matter - law of Definite composition

1. All matter is made of Atoms
2. All Atoms of the same element have the same chemical and physical properties. (different)
3. Atoms cannot be created, subdivided, or destroyed. (A-bombs) (protons, electrons, neutrons)
4. Atoms combined in different small whole number ratios to form compounds.
5. In chemical reactions, Atoms separate, rearrange and recombine to make new compounds.

#93 all manmade

Particle Model

● ← Atom

↳ wrong b/c of Isotopes - same elements but different mass.

Dalton - particle model

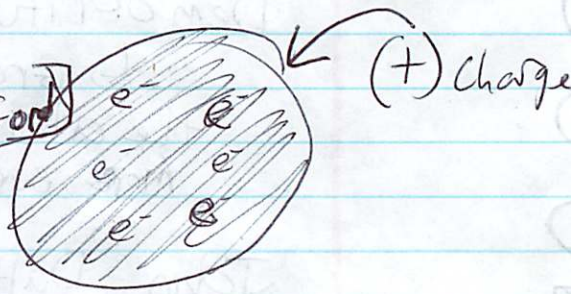
JJ Thompson - Cathode Ray tube to Discover electrons.

1897
CRT Produced negative beam of particles, Thompson called electrons.

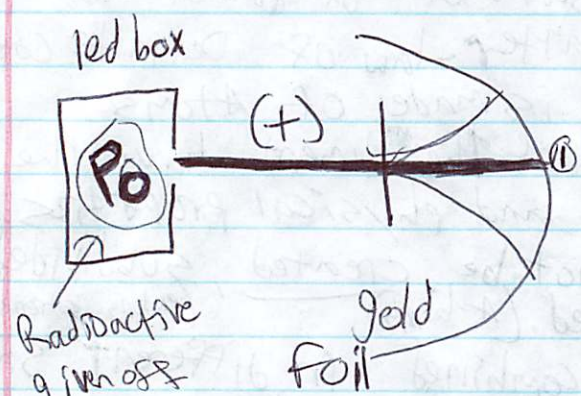
JJ Thomson. Plum Pudding Model

e^- = negative electrons

electrons are floating in a ~~[illegible]~~ cloud of positive charge.

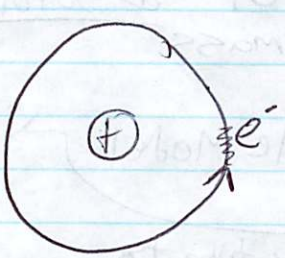


1908 Ernest Rutherford gold foil experiment - found [illegible]



1. Most Particles Pass through foil.
   ↳ Atom is mostly empty space.
2. Some particles deflect away
3. Very few particles bounce back off foil.

Solar System Model
- electrons orbit nucleus as planets orbit Sun.



Dense Partical inside
↓
Particle is Nucleus.

Anatomy

amu - atomic mass unit

$1\,amu = 1.66 \times 10^{-24}\ g$

relative mass

protons (p) → 1 amu

Neutron (n) → 1 amu

electron (e⁻) → 0 amu ($\frac{1}{2000}$ mass of p)

in nucleus (atoms mass)

Relative mass

in electron cloud (All atoms volume)

$1\,amu = 1.66 \times 10^{-24}\ g$

Strong force: holds together

- protons - (+)
- neutrons - (0)

electrons - (−)

	p	n	e⁻
I	53	74	53
Ca^{2+}	20	20	18
$^{37}_{17}Cl^-$	17	20	18

mass number → 37

atomic number → 17

Nuclear Stability

- When an element is radioactive, the nucleus is breaking down and new elements get formed.

Ex: $^{32}_{15}P$

mass # (protons and neutrons) → $^{32}_{15}P$ ← Atomic number (number of protons)

Symbol (Isotopic) Notation

$^{32}_{15}P \rightarrow$ When it decays, it gives off an electron $(^{0}_{-1}e) + ^{32}_{16}S$

$$^{236}_{92}U \rightarrow ^{4}_{2}He + ^{232}_{90}Th$$

1:1 ratio (P:N) makes element stable

As masses of elements ↑, the # of N ↑ and atoms become less stable.

Radioactive Decay

↳ one isotope of an element turn into another element releasing a particle.

2 kinds of particles released

↳ α - particle $^{4}_{2}He$ (Helium nucleus)

alpha

β - particle → $^{0}_{-1}e$ (electron)

Beta

heavy/slow moving - sheet of paper stops them (15 cm of air)

light/fast - paper can't stop them (Aluminum foil) ¼ in. plexiglass

Gamma ← γ - Rays → Energy (radiation) High energy

↳ inches of lead.

α - emmison

$^{238}_{92}U \longrightarrow {}^{4}_{2}He + {}^{234}_{90}Th$

Parent Isotope

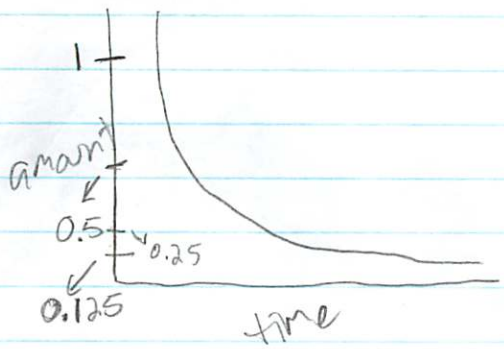
$^{214}_{84}Po \longrightarrow {}^{4}_{2}He + {}^{210}_{82}Pb$

β emissions ($^{0}_{-1}e$) In nucleus,

$^{1}_{0}n \longrightarrow {}^{0}_{-1}e + {}^{1}_{1}e$

½ Life - Time it takes for half of a radioactive isotope to break down.

Radioactive Decay is exponential



$^{218}Po \xrightarrow{\frac{1}{2}\text{ life}} 3.1\text{ min.}$

$^{238}U \rightarrow 4.5 \times 10^9$ years.

$^{133}Xe \rightarrow 5$ days

$^{133}Xe \rightarrow 5$ days 50g

$^{133}Xe \rightarrow 10$ days 25g

$^{133}Xe \rightarrow 15$ days 12.5

$^{133}Xe \rightarrow 20$ days 6.25g

(100yrs) 36.8g → 2.3g

2.3g x2 → 4.6g x2 → 2.2g x2 → 18.4g x2 → 36.8g.

25 years